

1 CLAIMS:

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3 1. A plasma enhanced chemical vapor deposition method
4 comprising:

5 placing a substrate within a plasma enhanced chemical vapor
6 deposition reactor;

7 providing a plurality of reactant gases within the reactor proximate
8 the substrate under high density plasma conditions effective to form a
9 layer on the substrate, the conditions resulting in etching of portions of
10 the layer during its formation and thereby including a deposition to etch
11 ratio of the forming layer; and

12 changing the conditions during the forming to change the
13 deposition to etch ratio.

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15 2. The method of claim 1 wherein changing the conditions
16 comprises changing a flow rate of at least one reactant gas to the
17 reactor during formation.

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19 3. The method of claim 1 wherein changing the conditions
20 comprises changing at least one power setting during formation.

1 4. The method of claim 1 wherein changing the conditions
2 comprises changing a flow rate of at least one reactant gas to the
3 reactor and changing at least one power setting during formation.

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5 5. The method of claim 1 wherein changing the conditions
6 comprises:

7 beginning with an environment providing a large deposition rate
8 relative an etch rate;

9 after the beginning, decreasing the ratio; and

10 after decreasing the ratio, increasing the ratio.

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12 6. The method of claim 1 wherein changing the conditions
13 comprises changing at least one of bias power on the substrate and flow
14 rate of at least one reactant gas into the reactor during formation.

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16 7. The method of claim 1 wherein changing the conditions
17 comprises maintaining constant power settings while changing a flow rate
18 of at least one reactant gas into the reactor during formation.

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20 8. The method of claim 1 wherein the layer comprises a
21 predominate SiO₂ comprising layer and deposition starts with substantially
22 no etching of the SiO₂ layer during its initial formation.

1 9. The method of claim 1 wherein the changing of the
2 conditions reduces the deposition to etch ratio at least once during
3 formation.

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5 10. The method of claim 1 wherein the changing of the
6 conditions reduces the deposition to etch ratio at least once during
7 formation and subsequently increases the deposition to etch ratio during
8 formation.

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10 11. A plasma enhanced chemical vapor deposition method
11 comprising:

12 placing a substrate within a plasma enhanced chemical vapor
13 deposition reactor;

14 providing a plurality of precursor gases within the reactor
15 proximate the substrate under high density plasma conditions effective to
16 form a layer on the substrate, the conditions resulting in etching of
17 portions of the layer during its formation and thereby including a
18 deposition to etch ratio of the forming layer; and

19 changing the conditions during the forming to continuously vary the
20 deposition to etch ratio throughout at least a majority of the forming.
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1 12. The method of claim 11 wherein changing the conditions
2 comprises continuously increasing the deposition to etch ratio at some
3 point after a majority of the layer has been formed.
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5 13. The method of claim 11 wherein changing the conditions
6 comprises:

7 beginning with an environment providing a large deposition rate
8 relative an etch rate;

9 after the beginning, decreasing the ratio;

10 after decreasing the ratio, increasing the ratio.
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12 14. The method of claim 11 wherein changing the conditions
13 comprises varying a flow rate of at least one precursor gas to the
14 reactor during formation.
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16 15. The method of claim 11 wherein changing the conditions
17 comprises maintaining constant power settings during formation.
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1 16. A semiconductor processing method of forming shallow trench
2 isolation regions within a semiconductive substrate comprising:

3 forming isolation trenches within a semiconductive substrate;

4 providing the substrate with trenches within a plasma enhanced
5 chemical vapor deposition reactor;

6 injecting at least a silane containing gas, an oxygen containing gas
7 and an inert gas into the reactor under high density plasma conditions
8 effective to form a predominate SiO₂ comprising layer on the substrate
9 to overfill the trenches, the conditions resulting in etching of portions
10 of the layer during its formation and thereby including a deposition to
11 etch ratio of the forming SiO₂ comprising layer; and

12 changing the conditions during the forming to change the
13 deposition to etch ratio.
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15 17. The method of claim 16 wherein changing the conditions
16 comprise starting with a high deposition rate as compared to any etch
17 rate, following with a reducing deposition to etch ratio and then
18 following with an increasing deposition to etch ratio.
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20 18. The method of claim 16 wherein changing the conditions
21 comprises changing a flow rate of at least one of the silane containing
22 gas, oxygen containing gas and inert gas.
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1 19. The method of claim 16 wherein changing the conditions
2 comprises changing a flow rate of the silane containing gas during
3 formation.

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5 20. The method of claim 16 wherein changing the conditions
6 further comprises varying a bias power on the substrate during formation.

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8 21. The method of claim 16 wherein changing the conditions
9 comprises substantially eliminating etching while continuing the deposition.

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11 22. The method of claim 16 wherein the deposition starts with
12 substantially no etching of the SiO₂ layer during its initial formation.

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14 23. A plasma enhanced chemical vapor deposition method
15 comprising:

16 placing a substrate within a plasma enhanced chemical vapor
17 deposition reactor;

18 providing a plurality of reactant gases within the reactor proximate
19 the substrate under plasma conditions effective to form a substantially
20 homogeneous layer of material on the substrate; and

21 reducing a flow of at least one of the reactant gases during at
22 least some of the forming and continuing forming the layer.

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1 24. The method of claim 23 wherein the plasma conditions
2 comprise etching conditions thereby providing an etch of the layer during
3 at least some of its formation.

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5 25. The method of claim 23 wherein at some point in time after
6 the deposition begins, the etching increases relative to the deposition.

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8 26. The method of claim 23 comprising maintaining substantially
9 constant power settings during formation.

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11 27. A plasma enhanced chemical vapor deposition method of
12 forming a SiO_2 comprising layer on a semiconductor substrate,
13 comprising:

14 placing a substrate within a plasma enhanced chemical vapor
15 deposition reactor;

16 injecting at least a silane containing gas, an oxygen containing gas
17 and an inert gas into the reactor under high density plasma conditions
18 effective to form a predominate SiO_2 comprising layer on the substrate;
19 and

20 reducing a flow of at least one of the silane containing gas and
21 the oxygen containing gas during the forming and continuing forming the
22 layer.

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1 28. The method of claim 27 wherein reducing a flow comprises
2 the silane containing gas.

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4 29. The method of claim 27 wherein reducing a flow comprises
5 the oxygen containing gas.

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7 30. The method of claim 27 wherein reducing a flow comprises
8 the silane containing gas and oxygen containing gas.

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